A FIRST ORDER ASSESSMENT OF THE POTENTIAL RADIOLOGICAL IMPACT OF FOODSTUFFS GROWN IN A CATCHMENT AREA INFLUENCED BY MINING AND MINERAL PROCESSING INDUSTRIES

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Natural radioactivity is associated with the vast mineral resources in South Africa in such concentrations that the radionuclides from the natural uranium and thorium decay series are found to pose concern for public exposure to communities living around these areas. Consumption of water and food is usually the most important route by which natural radionuclides can enter the human body and assessment of natural radionuclide levels in different foods and diets is therefore important to estimate the intake of these radionuclides by man. Sensitive measurement of three major nuclides (in addition to ^{238}U, ^{234}U, ^{232}Th, ^{226}Ra, ^{224}Ra and ^{223}Ra) is necessary to calculate the estimated annual dose with a high degree of certainty i.e. ^{230}Th, ^{210}Pb and ^{210}Po**,** while ^{231}Pa, ^{227}Ac and ^{228}Ra also require improved sensitivity. These nuclides have relatively high dose conversion factors (DCF). In order to evaluate the yearly dose due to an individual source at a screening level of 25 μSv/a, one is faced with a required sensitivity of 0.1 to 0.5 mBq/g for certain foodstuffs. In this study the potential radiological impact of foodstuffs grown in a catchment area influenced by mining and mineral reprocessing industries in South Africa, was determined by measuring the natural radionuclides in a number of foodstuffs collected from the area. The radionuclides were measured by non-destructive techniques such as Instrumental Neutron Activation Analyses (INAA) and low background gamma spectrometry.

It was observed that although some of the nuclides, specifically ^{238}U, ^{235}U and ^{232}Th can be determined conveniently by INAA, the direct instrumental techniques (INAA and γ-spectrometry) will be inadequate to provide suitable data for some of the nuclides such as ^{230}Th, ^{210}Pb, ^{210}Po, ^{231}Pa. High detection limits for these nuclides result in an overestimation of the calculated dose. Therefore, radiochemical separation through acid destruction of dried foodstuffs followed by individual element separations was used to measure the individual nuclides at the required sensitivity level.